Gravity Practice Sheet #2 KEY

1. $F_G = \frac{GMm}{r^2}$

$G = 6.67\times10^{-11}$
$M = 600\,kg$
$m = 100\,kg$
$r = 25\,m$

$F_G = \frac{(6.67\times10^{-11})(600\,kg)(100\,kg)}{(25\,m)^2}$

$\boxed{F_G = 6.40\times10^{-9}\,N}$

2. $F_G = \frac{GMm}{r^2}$

$G = 6.67\times10^{-11}$
$M = 6\times10^{4}\,kg$
$m = 1\times10^{3}\,kg$
$r = 75\,m$

$F_G = \frac{(6.67\times10^{-11})(6\times10^{4}\,kg)(1\times10^{3}\,kg)}{(75\,m)^2}$

$\boxed{F_G = 7.11\times10^{-7}\,N}$

3. $F_G = \frac{GMm}{r^2}$

$G = 6.67\times10^{-11}$
$M = 8.6\times10^{16}\,kg$
$m = 5\times10^{3}\,kg$
$r = 1000\,km = 1\times10^{6}\,m$

$F_G = \frac{(6.67\times10^{-11})(8.6\times10^{16}\,kg)(5\times10^{3}\,kg)}{(1\times10^{6}\,m)^2}$

$\boxed{F_G = 2.87\times10^{-2}\,N}$

4. $F_G = \frac{GMm}{r^2}$

$G = 6.67\times10^{-11}$
$M = 5.98\times10^{24}\,kg$
$m = 7.35\times10^{22}\,kg$
$r = 3.84\times10^{5}\,km = 3.84\times10^{8}\,m$

$F_G = \frac{(6.67\times10^{-11})(5.98\times10^{24}\,kg)(7.35\times10^{22}\,kg)}{(3.84\times10^{8}\,m)^2}$

$\boxed{F_G = 1.99\times10^{20}\,N}$

5. $F_G = \frac{GMm}{r^2}\left(\frac{r^2}{GM}\right)$

$m = \frac{r^2 F_G}{GM}$

$G = 6.67\times10^{-11}$
$M = 3000\,kg$
$m = ?$
$r = 30\,m$
$F_G = 1.012\times10^{-6}\,N$

$m = \frac{(30\,m)^2(1.012\times10^{-6}\,N)}{(6.67\times10^{-11})(3000\,kg)}$

$\boxed{m = 4.55\times10^{3}\,kg}$

6. $F_G = \frac{GMm}{r^2}$

$G = 6.67 \times 10^{-11}$

$M = 5.98 \times 10^{24}\ kg$

$m = 72\ kg$

$F_G = 707.75\ N$

$r = ?$

$\frac{r^2}{1} \frac{F_G}{G} = \left(\frac{GMm}{r^2}\right) \frac{r^2}{1}$

$\frac{r^2 F_G}{F_G} = \frac{GMm}{F_G}$

$\sqrt{r^2} = \sqrt{\frac{GMm}{F_G}}$

$r = \sqrt{\frac{GMm}{F_G}}$

$r = \sqrt{\frac{(6.67\times10^{-11})(5.98\times10^{24}\ kg)(72\ kg)}{(707.75\ N)}}$

$r = 6.37 \times 10^{6}\ m$

7. $M = \frac{r^2 F_G}{Gm}$

$G = 6.67 \times 10^{-11}$

$F_G = (165\ lbs)(4.45\ N/lbs) = 7.34 \times 10^{2}\ N$

$M = (165\ lbs)(.45\ kg/lbs) = 7.43 \times 10^{1}\ kg$

$r = 6.37 \times 10^{6}\ m$

$M = \frac{(6.37\times10^{6}\ m)^2 (7.34\times10^{2}\ N)}{(6.67\times10^{-11})(7.43\times10^{1}\ kg)} = 6 \times 10^{24}\ kg$

Earth!